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HNF-20632  
Revision 0

# END POINT CRITERIA FOR THE K BASINS INTERIM REMEDIAL ACTION

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Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the  
U.S. Department of Energy under Contract DE-AC06-96RL13200

**Fluor Hanford**

P.O. Box 1000  
Richland, Washington

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# END POINT CRITERIA FOR THE K BASINS INTERIM REMEDIAL ACTION

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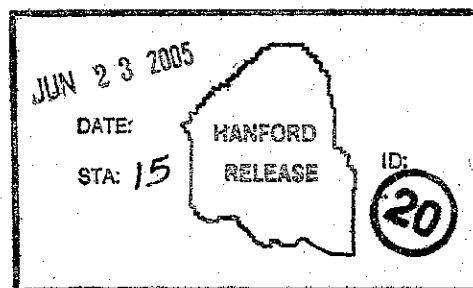
D. J. Watson  
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Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the  
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Richland Operations Office  
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05-AMCP-0304

**JUN 16 2005**

Mr. R. G. Gallagher, President  
and Chief Executive Officer  
Fluor Hanford, Inc.  
Richland, Washington 99352

Dear Mr. Gallagher:

CONTRACT NO. DE-AC06-96RL13200 – END POINT CRITERIA FOR THE K BASINS  
INTERIM REMEDIAL ACTION, HNF-20632, REVISION 0

The purpose of this letter is to respond to the April 15, 2005, (FH-0501099) request for RL and U.S. Environmental Protection Agency (EPA) approval of the subject document. RL and EPA have reviewed this document and enclosed is EPA's approval letter dated June 1, 2005. Please issue the subject document including a copy to the 100-KR-2 Administrative Record.

If, in my capacity as a Contracting Officer's Representative (COR), I provide any direction which your company believes exceeds my COR authority, you are to immediately notify the Contracting Officer and request clarification prior to complying with the direction.

If there are any questions, please contact me, or your staff may contact Paul Pak, of my staff, on (509) 376-4798.

Sincerely,

  
Matthew S. McCormick, Assistant Manager  
for the Central Plateau

AMCP:SKM

Enclosure

cc w/encl:  
S. W. Bork, FHI  
H. Hermanas, FHI  
P. M. Knollmeyer, FHI  
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 10 HANFORD/INL PROJECT OFFICE  
309 Bradley Boulevard, Suite 115  
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June 1, 2005

Paul M. Pak, Director  
K Basins Closure Project  
U.S. Department of Energy  
P.O. Box 550, A-16  
Richland, Washington 99352

Re: EPA Approval of "End Point Criteria For the K Basins Interim Remedial Action,"  
HNF-20632, Rev 0

Dear Mr. Pak: *Paul*

The U.S. Environmental Protection Agency has reviewed and approves the subject document, which we received via U.S. Department of Energy letter 05-AMCP-0257. Thank you for the opportunity to review and discuss earlier versions of this letter with your staff and contractors. If you have any questions, please feel free to contact me at 509-376-9884.

Sincerely,

*Larry Gadbois*

Larry Gadbois  
K Basins Project Manager

cc: Dave Watson, Fluor  
Administrative Record, 100-KR-2



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## Acronyms

ALARA	As low as reasonably achievable
ARAR	Applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CVDF	Cold Vacuum Drying Facility
DOE	United States Department of Energy
DQO	Data quality objective
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
FFS	Focused Feasibility Study
GTCC	Greater Than Class C (wastes)
IWTS	Integrated water treatment system
LDR	Land Disposal Restrictions
MCO	Multi-canister overpack
nCi	nano-Curies
NEPA	National Environmental Policy Act
PCB	Polychlorinated biphenyl
SAP	Sampling and Analysis Plan
SNF	Spent nuclear fuel
SPR	Single pass reactor
Tc <sup>99</sup>	Technecium 99
TPA	Tri-Party Agreement ( <i>Hanford Federal Facility Agreement and Consent Order</i> )
TRU	Transuranic
TSCA	Toxic Substances Control Act
WAC	Washington Administrative Code
WAC	Waste Acceptance Criteria

## Definitions

Canistered Fuel	Fuel stored in fuel canisters, but also stored in baskets (single pass reactor [SPR] fuel), Single Element Fuel Containers, Remnant Return Canisters and sample containers. (Derived from HNF-19247.)
Debris	<p>Debris is defined as anything (e.g., equipment and material) that is over 0.25 in. in largest dimension, is not a permanent structure within the basin*, is not used for current or planned operations or maintenance activity, and is not fuel or sludge. <i>Debris</i> includes such items as empty fuel canisters, old equipment, hand tools, and miscellaneous irradiated and non-irradiated items.</p> <p>* "Within the basins" means in the basin water or under the grating of either the basin or one of the adjacent pits.</p>
End Point Criteria	Defined conditions that must exist before deactivation and the overall K Basin CERCLA interim remedial action can be considered complete (DOE-RL, 2001)
Found Fuel	Found fuel refers to any fuel that is not "canistered fuel" and is "found" in K Basins during debris retrieval or sludge retrieval.
Fuel	<i>Fuel</i> is defined as all <i>spent nuclear fuel</i> that is greater than .25 inches in diameter (derived from WHC-SD-SNF-SP-005). For purposes of differentiating <i>fuel</i> from <i>sludge</i> and <i>debris</i> , any material that will pass through a screen with 0.25-inch openings is defined as sludge (HNF-SD-TI-015, Volume 2, Sludge, Section 3.0). This definition applies to all K Basins remediation activities.
Fuel Assembly	<i>Fuel assembly</i> consists of concentric inner and outer fuel elements of N Reactor fuel. Whole or partial elements containing an intact circular section for a portion of the element or segment length longer than 3 inches may be stacked into an MCO fuel basket in the form of assemblies.
Fuel Fragment	Fuel fragment is an informal term used to describe pieces of fuel of any size, implying that it is fuel, which is not a whole <i>fuel element</i> or <i>fuel assembly</i> . These would likely be classified as <i>fuel scrap</i> based on size.
Fuel Scrap	<p><i>Fuel Scrap</i> is defined as any <i>fuel</i> that is not "loadable" in an MCO fuel basket (derived from K Basins SAR, Section 2.5.5.1.5). See <i>fuel assembly</i> definition.</p> <p><i>Coarse scrap</i> is <i>fuel scrap</i> greater than 1 inch in any dimension.</p> <p><i>Fine Scrap</i> is <i>fuel scrap</i> that is greater than 0.25 inch but less than 1 inch in all dimensions. By definition, <i>fuel</i> that is less than 0.25 inch is <i>sludge</i>.</p>

- Sludge                      Sludge is any material in the K Basins water that will pass through a screen with 0.25 in. (.64 cm) openings. Sludge on the floor and in the pits is a mix of fuel corrosion products (including metallic uranium, and fission and activation products), small fuel fragments, iron and aluminum oxide, concrete grit, sand, dirt, operational debris, and biological debris.
- Spent Nuclear Fuel      10 CFR 960.2 and 40 CFR 191.02 defines *spent nuclear fuel* as “fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.”

## 1.0 INTRODUCTION

### 1.1 PURPOSE AND SCOPE

The purpose of this document is to define the conditions that must exist to consider the K Basins interim remedial action complete in the form of end point criteria. For the K Basins interim remedial action, end point criteria also provide the framework to develop data quality objectives (DQOs) and sampling and analysis plans (SAPs) for the remedial action, and to develop indirect or direct measurement techniques or processes to demonstrate how the criteria are satisfied. These SAPs will form a part of the project closure documentation which will demonstrate how waste acceptance criteria at applicable waste storage and disposal facilities are met (DOE-RL, 2001) (Section 5.2).

End point criteria for the deactivation phase of the K Basins were not included in the *Remedial Design Report/Remedial Action Work Plan (RDR/RAWP) for the K Basins Interim Remedial Action* (DOE-RL, 2001) (Section 5.1.1) and their development was deferred until further details were available. Details of deactivation have progressed significantly to support the development of end point criteria described herein. For completeness this document reiterates the remedial action scope for fuel, sludge, debris, and water removal, as identified in the *ROD for the K Basins Interim Remedial Action* (EPA, 1999b), including the planned changes to the scope defined in the Tri-Party Agreement (TPA) Change No. M-34-04-01, and provides end point criteria to define the conditions that must exist to consider those phases of the interim remedial action complete as well as the remedial action objectives.

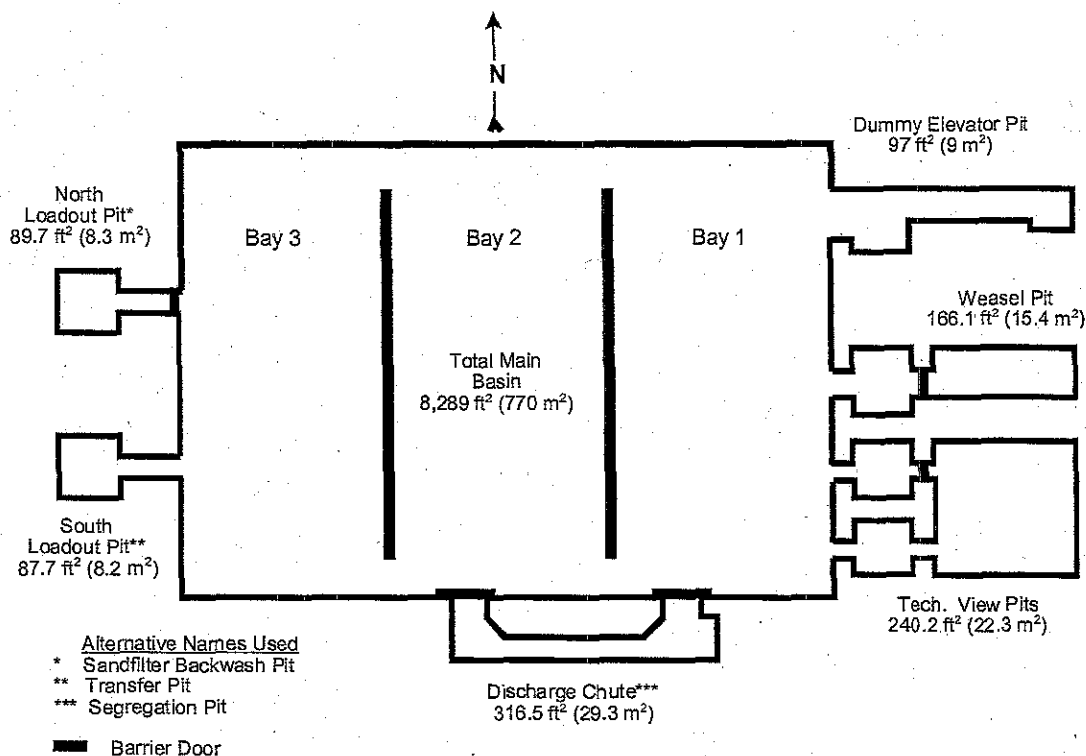
This document does not discuss end point criteria for spent nuclear fuel (SNF) after removal from the K Basins as that is outside the scope of the K Basins interim remedial action. Nor does this document discuss end point criteria for in situ contaminated soil or other remedial activity after removal of the basins as this is also outside the scope of the K Basins interim remedial action.

The scope of the sludge remedy is being expanded to include treatment and packaging for disposal per a pending ROD amendment. The end point criteria for sludge treatment and packaging for disposal will be finalized pending a ROD amendment. Accordingly, the criteria presented herein constitutes interim criteria that accommodates the expanded scope of the sludge remedy.

### 1.2 BACKGROUND

The KE and KW Basins were constructed in the early 1950s. Each basin is 125-ft long by 67-ft wide and is divided into three, approximately equally sized bays, with several pits located to the east and west of the main basin and a discharge chute located between the 105 K Reactor Building and the basin. The dividing walls between bays are cantilevered from the floor and do

not tie into the outer walls. A 38-inch (in.) gap exists on each end of the dividing walls between the dividers and the outer walls that allow a pathway between bays (Figure 1).



**Figure 1: K Basins Plan View**

Each basin is 21-ft deep, and the water depth is maintained at approximately 16 ft. The basin floors are covered with a rack system that held fuel canisters. These racks are constructed of angle iron and pipe. The tops of the racks are 19 in. above the basin floor. The racks contain a matrix of 12-in. by 20-in. openings that held the fuel canisters in a vertical position.

Six pits and an inactive fuel discharge chute are located around the perimeter of each basin. Barrier doors at the discharge chutes isolate them from the main basin areas. The KE discharge chute has been cleaned, dewatered and isolated from the KE Reactor using a specially formulated grout. The basins are covered with a grating system suspended from the superstructure. An overhead monorail system is used to support equipment in the basin.

The KE and KW Reactors operated from 1955 until 1970 and 1971, respectively. Most of the SNF in the K Basins was removed at the time of the shutdown. The K Basins were reused to store SNF from the N Reactor beginning in 1975 for K East and 1981 for K West until 2004 when removal of canistered fuel was completed. A significant fraction of the fuel stored in the KE Basin during this period degraded because of cladding breaches caused during reactor discharge and corrosion from long-term underwater storage in open top canisters. Over time corrosion products from the degrading fuel rods, storage rack rust, concrete from pool walls, and environmental particulates accumulated as sludge in fuel canisters, on the floor, and in the pits of the KE Basin.

The SNF and sludge released soluble fission products into the basin water and past leaks from the basins have contaminated the underlying soil and groundwater. During the late 1970s increased basin water leakage was noted and subsequent actions were taken in the 1980s and 1990s to mitigate the leaks.

The purpose of the K Basin CERCLA interim remedial action is to mitigate the potential to release hazardous substances from the K Basins. The scope of the remedial action is as follows:

- Remove SNF, sludge, debris, and water from the basins;
- Transfer SNF to the 100-K Area Cold Vacuum Drying facility;
- Remove sludge from K Basins, treat, and ship off Hanford for disposal.;
- Treat non-TRU sludge to meet ERDF waste acceptance criteria and dispose at ERDF;
- Treat water with the Integrated Water Treatment System (IWTS) and transfer it to the Effluent Treatment Facility (ETF);
- Treat debris, and transfer to disposal or storage facilities in the 200 Area; and
- Deactivate the basins, and remove them under the *100 Area Remaining Sites Interim Action ROD*.

Under the 1999 remedial design, a period of surveillance and maintenance was anticipated after deactivation of the K Basins prior to removal under a separate CERCLA action: the *100 Area Remaining Sites Interim Action ROD*. TPA Change No. M-34-04-01 removed this period of interim surveillance and maintenance and added the removal of the K Basins to the scope of the K Basin interim remedial action and accelerated their removal based on an earlier established TPA Milestone M-16-52.

### 1.3 ACCELERATED BASIN CLOSURE

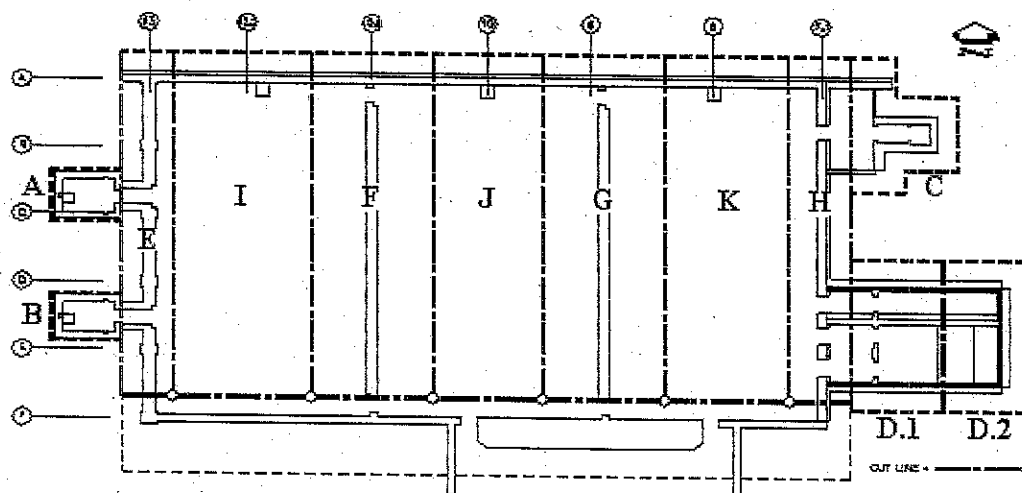
During 2003 and 2004 the overall approach for the K Basins deactivation was reevaluated. KE Basin characterization data and an alternate deactivation approach revealed opportunities to integrate basin debris management with basin deactivation in a manner that reduces cost and exposure from removing debris separately while accelerating removal of the basin (FH, 2004a). Planning for the removal of KE Basin debris and deactivation of the basin showed that there had been significant migration of cesium-137 into the uncoated concrete surfaces of the KE Basin. These concrete surfaces would have to be removed or shielding put in place to reduce the radiation exposure to allowable limits during basin dewatering. Therefore, considering the radiological hazards that would be experienced during dewatering and goals for keeping occupational radiological exposures as low as reasonably achievable (ALARA), a remedial design to grout the bottom of the basin that also would encapsulate debris left in place was evaluated and proposed as the preferred method for deactivating and removing the basins. As the basins already were scheduled for removal starting in 2009 (TPA Milestone M-16-52) under the *ROD for the 100 Area Remaining Sites Interim Action*, a means of removing the encapsulated debris along with the basin structure was shown to have life cycle cost savings as well as ALARA benefits. This deactivation approach is referred to as "Grout and Remove." While a similar approach is anticipated for the KW Basin, levels of contamination are not as high as those encountered at KE and the extent of actions leading to basin removal may vary.

Concurrently, previous remedies for the management of sludge were also reevaluated and changed. The alternative selected eliminates the interim storage of untreated sludge and specifies treatment for disposal off site soon after removal from the basin. Design changes addressing sludge and accelerated basin removal were embodied in TPA Change No. M-34-04-01. The scope of the changes to the remedies includes:

- Remove sludge from the K Basins, treat, and ship off Hanford for disposal;
- Concrete surface removal of the basin floor and walls, where necessary, to reduce dose and facilitate segmenting the basin for disposal;
- Segregation and relocation of underwater debris for grouting;
- Placement of grout for stabilization of the basin contaminants and selected debris, and to provide shielding.

The K Basins will be removed under the *100 Area Remaining Sites Interim Action ROD*. Details of basin removal techniques are not described in the *RDR/RAWP for the 100 Area*. Basin removal techniques will be included in a supplement or revision to the *RDR/RAWP for the K Basins Interim Remedial Action*. Major activities associated with basin removal include:

- Basin superstructure removal and disposal at ERDF;
- Excavation of soil surrounding the basin as necessary to remove the basins and contaminated soil for disposal at ERDF;
- Cutting of the basin into large monoliths (Figure 2. KE Basin conceptual cut lines);
- Removal of the basin monoliths followed by disposal at ERDF; and
- Installation of weatherproofing and/or repair of the north wall of the reactor building where the basin was removed.



**Figure 2: Conceptual KE Basin "Grout and Remove" Cut Lines**

Upon removal of the basins, contaminated soil will be removed as described in the *RDR/RAWP for the 100 Area* (DOE-RL, 1996) in a follow-on interim remedial action.



## 2.0 END STATE AND END POINT CRITERIA

The end state for the K Basins interim remedial action is identified in TPA Change No. M-34-04-01 as milestones:

- M-34-32: Complete removal of the K East Basin structure, and
- M-34-00A: Complete removal of the K Basins and their content.

To achieve the K Basin interim remedial action end state, interim end points for fuel, sludge, water and debris removal must be achieved, consistent with remedial objectives specified in the ROD. To define the conditions that must exist to consider the K Basins interim remedial action complete, end point criteria were needed for fuel, sludge, water, and debris removal, as well as for the sludge treatment and packaging and basin removal. These end point criteria are discussed below. Details of the Applicable or Relevant and Appropriate Requirements (ARARs); criteria, advisories, or guidance to-be-considered (TBC); and other basis documents used in developing the end point criteria are discussed in Appendix A.

### 2.1 FOUND FUEL

The *ROD for the K Basins Interim Remedial Action* (Section 11.1) indicates that fuel will be removed from the K Basins and transferred to the cold vacuum drying facility (CVDF). The end point criteria for the removal of canistered fuel from the K Basins has been met by satisfying TPA Milestone M-34-18B. Fuel scrap (referred to as found fuel) is anticipated to be uncovered during debris and sludge removal. Found fuel must be removed from the basins prior to grouting since the grouted basins and debris will be disposed of at the Environmental Restoration Disposal Facility (ERDF). Fuel is not accepted for disposal under the ERDF Waste Acceptance Criteria (WAC) (BHL, 2002).

#### 2.1.1 Criteria

The conditions that must exist to consider that the found fuel end point criteria have been met are:

1. A visual inspection of the floor has been performed using individuals familiar with fuel scrap visual characteristics and has been documented using standard, commercially available imaging methods (e.g., video, photographic, or similar), or written logs;
2. Objects that appear to be found fuel have either been removed from the basin or evaluated by a secondary process, such as radiation measurement, and determined to not be found fuel;
3. Fuel canisters, sludge strainers, or other fuel collection devices, which have the potential to contain fuel, have either been evaluated to ensure they contain no found fuel or have been removed from the basin; and
4. Found fuel has been removed from the basin to a suitable location.

## 2.2 SLUDGE

The sludge remedy described in the *ROD for the K Basins Interim Remedial Action* (Section 11.2) as amended in TPA Change No. M-34-04-01 defines that sludge will be removed from the basins, treated, packaged for off site disposal, and shipped off Hanford to disposal. The ROD defines sludge as a RH TRU PCB remediation waste and further indicates that:

“If it is determined during remedial design that a portion of the sludge could be treated to meet the ERDF waste acceptance criteria, and it is practicable and cost effective, then that treatment will be done as part of this interim remedial action. The treatment for ERDF disposal may take place at either the K Basins or the ERDF.”

Under accelerated basin closure the sludge removal remedy remains unchanged. Sludge will be removed from the basins and residues will be encapsulated within the monoliths to meet the ERDF WAC. Sludge end point criteria have been developed as identified below.

### 2.2.1 Criteria

The conditions that must exist to consider that the K Basin accelerated basin closure sludge end point criteria have been met are:

1. Sludge has been removed to the maximum extent practicable in accord with a qualified process approved by DOE-RL and EPA.
2. Sludge has been removed to the extent that residues on the floor, on or in debris, and within other matrices grouted in each basin monolith (see Figure 2) do not result in the monolith exceeding the ERDF WAC, as determined according to an approved *Sampling and Analysis Plan* (SAP); and
3. The volume of sludge residues remaining in each monolith section has been estimated and documented according to an approved SAP.
4. Sludge has been treated and packaged into a waste form suitable for off site disposal and shipped off Hanford to disposal.

## 2.3 DEBRIS

Above water debris will be removed from the K Basins and will be disposed of as described in the *ROD for the K Basins Interim Remedial Action* (Section 11.4). Underwater debris at the K Basins will be segregated based on its disposal pathway: removed and disposed directly to a 200 Area storage or disposal facility; or debris to be grouted in the basin and disposed at ERDF integral with the grouted basin monoliths. Underwater debris that will be grouted in situ will be prepared and relocated within the basin according to criteria established in an approved SAP for the disposal of grouted basin monoliths at ERDF.

### 2.3.1 *Criteria*

The conditions that must exist to consider that the above water debris end point criterion has been met are:

1. Above water debris has been removed from the building including appropriate segregation and characterization under an approved SAP for disposal or storage pursuant to the *RDR/RAWP for the K Basins Interim Remedial Action*; and has been staged or transferred to disposal or storage facilities in the 200 Area.

The conditions that must exist to consider that the underwater debris end point criteria have been met are:

1. A visual examination will be performed to identify those types of debris that have to be removed and disposed separately. These types of debris are those that would designate as a dangerous waste and can not be treated by such methods as macro encapsulation, washing, etc. which would allow this type of debris to be treated in situ and grouted as part of the basin monoliths.
2. Debris that will remain in the basin has undergone a process to remove sludge from external surfaces to the maximum extent practicable and to the extent necessary such that that sludge residues on the floor, on or in debris, and within other matrices grouted in the monolith do not result in the monolith exceeding the ERDF WAC, as determined according to an approved SAP;
3. Debris that could contain sludge in its internal volume; a) has been sectioned to expose internal volume such that sludge removal can be conducted to the maximum extent practicable, b) has undergone internal inspection or flushing to remove the sludge inventory to the maximum extent practicable and, c) has been accounted for such that that sludge residues on the floor, on or in debris, and within other matrices grouted in the monolith do not result in the monolith exceeding the ERDF WAC, as determined according to an approved SAP;
4. Underwater debris has been oriented or sectioned such that free liquids (basin water) in void spaces are displaced by grout to the extent necessary to meet ERDF WAC;
5. Debris has been inventoried as necessary for characterization as determined according to an approved SAP;
6. An inventory of aluminum remaining in the basin waste matrix has been established, as necessary.

## 2.4 **WATER**

The *ROD for the K Basins Interim Remedial Action* (Section 11.3) indicates that water will be removed from the K Basins for treatment at the Effluent Treatment Facility (ETF). The end point for the removal of water remains unchanged and water will be removed as described in the *RDR/RAWP for the K Basins Interim Remedial Action*.

#### **2.4.1 Criteria**

The conditions that must exist to consider that the water end point criteria have been met are:

1. Water has been removed from the basin to the extent that free liquids are not visibly present; and
2. Water removed from the basin has been transferred to the Effluent Treatment Facility (ETF) for disposal as described in the *RDR/RAWP for the K Basins Interim Remedial Action*.

### **2.5 BASIN REMOVAL**

The K Basins will be removed as part of the K Basin Interim Remedial Action per TPA Change M-34-04-01. This includes removal of the basins following the removal of the basin roof and superstructure, and installation of weatherproofing or repair of the north wall of the reactor building where the basin was removed.

#### **2.5.1 Criteria**

The conditions that must exist to consider that the basin removal end point criteria have been met are:

1. The end point criteria for found fuel, sludge removal, water and debris have been met.
2. Spoils from decontamination processes used (e.g. hydrolasing) were either grouted within the basin or have been collected and characterized according to an approved SAP; and have been transferred to disposal or storage facilities in the 200 Area.
3. Building interior surfaces are decontaminated or shielded to dose rates that meet ARARs and ALARA requirements, and where necessary fixatives have been applied to control airborne contamination
4. The basin superstructure has been removed and has been transferred to ERDF for disposal;
5. Basin concrete monoliths have been removed and have been transferred to ERDF for disposal;
6. Contaminated soils removed to facilitate basin excavation have been either staged for transfer or transferred to ERDF for disposal;
7. Uncontaminated soils removed to facilitate basin excavation have been stockpiled for future use;
8. Debris encountered during basin removal have been transferred to ERDF for disposal;
9. The south wall of the basin, which will remain as part of the reactor building has been prepared to meet ARARs and radiological control requirements; and

10. The portion of the north wall of the reactor building where the basin was removed has been weatherproofed or repaired to prevent entry of animals.

### 3.0 RECORDS

Records documenting that end point criteria have been met will be included in the project closure report in accordance with the *RDR/RAWP for the K Basins Interim Remedial Action*, Section 5.2, Project Closure Documentation.

### 4.0 APPROVAL AND IMPLEMENTATION

The K Basin end state and end point criteria identified in this document were developed to satisfy requirements in the *RDR/RAWP for the K Basins Interim Remedial Action*. The end point criteria described herein define the conditions that must exist before the K Basins interim remedial action can be considered complete. These end point criteria are subject to review and approval by EPA per Section 5.1.1 of the *RDR/RAWP for the K Basins Interim Remedial Action*.

Details of the remedial action changes will be included in supplements or revisions to the *RDR/RAWP for the K Basins Interim Remedial Action*. Supplements or revisions to Section 4.2, Planning and Documentation of the RAWP, or a corresponding section, will identify SAPs and other processes to be used to meet the end point criteria and the approval authority needed for each. SAPs developed for CERCLA remedial actions at the Hanford Site, such as those referenced in Section 2.0 of this document and Section 4.2 of the RAWP, are subject to EPA approval.

### 5.0 REFERENCES

- DOE-RL, 1996, DOE/RL-96-17, Rev. 4, *Remedial Design Report and Remedial Action Work Plan for the 100 Area*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2001, DOE/RL-99-89, Rev. 1, *Remedial Design Report and Remedial Action Work Plan for the K Basins Interim Remedial Action*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2004, DOE/RL-98-66, Rev. 0 Addendum, *Addendum to the Focused Feasibility Study for the K Basins Interim Remedial Action*
- EPA, 1999a, EPA/ROD/R10-99/039, *Interim Action Record Of Decision: 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6 AND 200-CW-3 Operable Units*, U.S. Environmental Protection Agency, Richland, Washington.

EPA, 1999b, EPA/ROD/R10-99/059, *Record of Decision for the K Basins Interim Remedial Action*, U.S. Environmental Protection Agency, Richland, Washington.

BHI, 2002, BHI-00139, Rev 4, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2003, BHI 0000X-DC-W0001, Rev. 5, *Supplemental Waste Acceptance Criteria for Bulk Shipments to the Environmental Restoration Disposal Facility*, Bechtel Hanford, Inc., Richland, Washington.

FH, 2004, SNF-9430, Rev. 1, *Waste Management Plan for K Basins Interim Remedial Action*, Fluor Hanford, Richland, Washington.

FH, 2003, HNF-19247, *Common Definitions for K Basins Remediation*, Rev 0, December 2003, Fluor Hanford, Richland, Washington.

TPA Change No. M-34-04-01, *Acceleration of K Basins Sludge Treatment and Disposal, Basin Remediation, and Delay in Sludge Retrieval*, August 2004

## **Appendix A**

### **End Point Criteria Bases**

## END POINT CRITERIA BASES

1.0 The Applicable or Relevant and Appropriate Requirements (ARARs) and to-be-considered (TBCs) described in Sections 2.0 and 3.0 were developed based on review of:

- Federal and state ARARs; and criteria, advisories, or guidance TBC listed in Section 12.2 of the *ROD for the K Basins Interim Remedial Action*, and Section XII of the *ROD for the 100 Area Remaining Sites*;
- Implementing documents referenced in the *RDR/RAWP for the K Basins Interim Remedial Action*;
- Details of the applicability, substantive requirements, design features needed in the remedial design, and other relevant procedures and documents to meet the ARARs and TBC criteria identified in Sections 3.1 and 3.2 of the *RDR/RAWP for the K Basins Interim Remedial Action* and section 2.1.6 of the *RDR/RAWP for the 100 Area*.
- TPA Change M-34-04-01, August 2004
- 100 Area Remaining Sites CERCLA ROD (EPA 1999a)
- Addendum to the Focused Feasibility Study for the K Basins Interim Remedial Action, January 2005, DOE/RL-98-66, Rev. 0, Addendum

Based upon review of these documents, and an evaluation of the primary aspects of the Grout and Remove strategy (i.e., removal of the basins and grouted debris to ERDF for disposal), radiation protection ARARs and the *Environmental Restoration Disposal Facility Waste Acceptance Criteria* "to-be-considered material" were determined as the primary drivers for development of end point criteria for basin removal. By meeting the ERDF WAC, the Federal and State ARARs for disposal of the monoliths are met.

Although other ARARs and to-be-considered materials continue to apply to the Grout and Remove remedial action, for example to basin water disposal or emissions to the air, they did not influence development of the end point criteria.

Therefore, the development of the end point criteria evolved around understanding the end point for the project, namely *removal of the KE Basin* to ERDF for disposal, and the requirements associated with preparing the basin monoliths for disposal at ERDF, and for preparing the south wall of the basins to meet ARARs and radiation protection standards.

Notwithstanding the ERDF WAC and radiation protection requirements, this evaluation also considered the expectations of the EPA, Department of Ecology and DOE-RL for the K Basins interim remediation as documented in the *ROD for the K Basins Interim Remedial Action* and the *ROD for the 100 Area Remaining Sites*.



As applicable, sludge will be treated and packaged as a RH TRU waste in a form meeting the requirements of DOE/WIPP-02-3214, *Remote-Handled TRU Waste Characterization Program Implementation Plan, Rev. 0D, (Subject to Approval)*.

## 2.0 Basin Deactivation and Removal

### 2.1 ARARs

As previously described, the Federal and State ARARs for disposal of the monoliths are met by meeting the ERDF WAC and therefore are not reiterated herein. However, radiation protection ARARs were also determined to influence development of the end point criteria since this interim action will leave the south wall of the basin, which is common with the reactor building, in place. These ARARs include the following:

- < 100 mrem/year total effective dose equivalent and 2 mrem/hr from external exposure in *unrestricted areas*<sup>1</sup> to individual members of the public (10 CFR 20).
- Dose equivalent does not exceed 25 mrem/year to the whole body, 75 mrem/year to the thyroid, and 25 mrem/year to any other organ of any member of the public (40 CFR 190)
- Total effective dose equivalent of 5 rems/year to workers (10 CFR 835)

### 2.2 To-be-Considered Material – ERDF WAC

Eight key substantive requirements were identified in the ERDF WAC. These requirements must be implemented to ensure the monoliths are prepared to meet the ERDF WAC and expectations in the *ROD for the K Basins Interim Remedial Action*. Each monolith resulting from the Grout and Remove activity shall meet the following requirements:

1. Must not contain fuel;
2. Must not be Transuranic (TRU);
3. Must not be Greater Than Class C (GTCC) waste;
4. Must satisfy ERDF criteria associated with isotopic inventories;
5. Must not contain free liquid;
6. Must not generate unacceptable levels of hydrogen; therefore, aluminum content may be limited;

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<sup>1</sup> Unrestricted area means an area, access to which is neither limited nor controlled by the licensee.

7. Must demonstrate that dose rates meet as low as reasonably achievable (ALARA) and ERDF requirements; and
8. Must meet ERDF Hazardous Waste disposal requirements for identified hazardous constituents.

A discussion of each of the requirements and their basis is described below. Documentation of conformance with the requirements described in the *Sampling and Analysis Plan for the 105-K East Basin Monoliths*.

1. Must not contain fuel.

The ERDF WAC, Section 4.3.5 *General Restrictions* precludes acceptance of spent nuclear fuel. Specifically the WAC states "The following materials are prohibited from being disposed at the ERDF ... Spent Nuclear Fuel and High Level Waste ...." This requirement to exclude fuel from ERDF is derived from the 40 CFR 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste*, which specifically bans the shallow land disposal of spent fuel.

2. Must not be TRU.

The ERDF WAC, Section 4.3.5 *General Restrictions* precludes the acceptance of TRU waste. Specifically the WAC states "The following materials are prohibited from being disposed at the ERDF ... Transuranic waste ...." To meet this requirement it must be shown that the concentration of transuranics in each monolith is less than 100 nano-curies per gram. This requirement is derived from 40 CFR 191, which specifically bans the shallow land disposal of TRU waste and 40 CFR 61.55.

3. Must not be GTCC waste.

The ERDF WAC, Section 4.3.5 *General Restrictions* precludes the acceptance of GTCC waste. Specifically the WAC states "The following materials are restricted from disposal at the ERDF until the listed conditions have been met ... Waste exceeding the Class C ... unless justified by a specific performance assessment ...." This requirement is derived from 10 CFR 61.55, which specifically bans the shallow land disposal of GTCC waste.

4. Must satisfy ERDF concentration limits for radionuclides.

The ERDF WAC, Section 4.2.2 *Radionuclides* requires that the sum of fractions be less than one; where for each given isotope the fraction is

calculated by taking the ratio of the concentration in the waste stream divided by a specified maximum concentration in the WAC and all fractions are summed. This requirement is derived from the long-term performance assessment for ERDF and ensures that the dose from releases over the long-term life of the disposal facility is bounded. Waste that does not meet this requirement can be accepted by agreement with ERDF.

In addition, the ERDF WAC identifies trigger level for selected isotopes. If the total inventory in curies of an identified isotope contained in a waste stream is less than the trigger level for that isotope, then the waste stream meets the WAC for that isotope. If the total inventory is greater than the trigger level it must be evaluated and an agreement negotiated with ERDF.

Acceptance of a sum of fractions for the grout and remove monoliths and the levels of individual isotopes such as Tc99 will be documented in the Monolith Waste Profile established by ERDF as a result of the development of data quality objectives (DQOs) and the *Sampling and Analysis Plan for the 105-K East Basin Monoliths*.

5. Must not contain free liquids.

The ERDF WAC Section 4.3.5 *General Restrictions* restricts the acceptance of waste containing free liquid. Specifically the WAC states "The following materials are restricted from disposal at the ERDF until the listed conditions have been met ... Bulk disposal of waste containing free liquids, unless the free liquids are eliminated by stabilization ..." and "Containerized waste holding free liquids ... convert into a form that contains as little free-standing and non-corrosive liquid. This requirement is derived from 10 CFR 61.56 and Washington Administrative Code (WAC) 173-303.

6. Must not generate unacceptable levels of hydrogen; therefore, aluminum content may be limited.

The ERDF WAC Section 4.3.5 *General Restrictions* prohibits the acceptance of waste capable of generating toxic gases, vapors, or fumes harmful to person transporting, handling, or disposing the waste. Chemical reactions involving aluminum and grout can generate hydrogen gas. To ensure that hydrogen gas concentration does not exceed the lower flammability limit, calculations shall establish an acceptable aluminum inventory. This requirement is derived from 10 CFR 61.56 and WAC 173-303.

7. Must demonstrate that dose rates meet ALARA and ERDF requirements.

Grout and remove monoliths must have dose rates low enough to meet the ERDF ALARA WAC (Section 4.1.1) and the Supplemental WAC (BHI, 2003) (Section 2.0). This requirement is derived from 10 CFR 835 and transportation safety requirements.

8. Must meet ERDF Hazardous Waste disposal requirements for identified hazardous constituents.

The ERDF WAC identifies requirements for hazardous wastes (Sections 3.2.1.2, 4.1.4, and 4.2.1), polychlorinated biphenyls (PCBs) (Section 4.3.4) and hazardous debris (4.3.3). Basin sludge is considered a PCB waste based on low concentrations of PCBs resulting from a hydraulic oil spill. As such, debris, including the basin concrete walls that have contacted sludge is considered a PCB remediation waste. ERDF can accept PCB remediation waste.

Inherently hazardous underwater debris regulated under 40 CFR 268.45 and elemental lead regulated under 40 CFR 268.40 are anticipated in small quantities while preparing the basins for grouting.

Macroencapsulation (grouting) under both standards is an acceptable treatment and therefore the encapsulated material can be disposed at ERDF. The debris treatment standards also allow for surface removal technologies to be used to remove other types of hazardous contaminants from debris. Although this type of debris is not anticipated, it was considered in this evaluation. Debris that cannot be treated to meet the LDR treatment standards must be removed and treated as above water debris.

This requirement is derived from 40 CFR 260, 261, 268, 761 and WAC 173-303.

### 3.0 Sludge Treatment and Packaging for Off Site Disposal

#### 3.1 ARARs

Sludge shall be treated and packaged and disposed in a manner that is protective of human health and the environment as described in 40CFR191, *Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High- Level and Transuranic Radioactive Waste*.

3.2 To-be-Considered Material WIPP WAC

Sludge will be treated and packaged as a RH TRU waste in a form meeting the requirements of DOE/WIPP-02-3214, *Remote-Handled TRU Waste Characterization Program Implementation Plan, Rev. 0D, (Subject to Approval)*.